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EXAMINER

TABONE JR, JOHN J

ART UNIT

PAPER NUMBER

2133

DATE MAILED: 07/06/2004

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Please find below and/or attached an Office communication concerning this application or proceeding.

SK

Office Action Summary

Application No.

10/073,129

Applicant(s)

SATO ET AL.

Examiner

John J. Tabone, Jr.

Art Unit

2133

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 13 February 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-15 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-15 is/are rejected.
- 7) ☒ Claim(s) 13-14 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on _____ is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
- 1) ☒ Certified copies of the priority documents have been received.
 - 2) ☐ Certified copies of the priority documents have been received in Application No. _____.
 - 3) ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>2</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. Claims 1-15 have been examined.

Specification

2. The disclosure is objected to because of the following informalities: Page 2 line 1 exhibits a typographical error "Lain-Open". This should be corrected to "Laid-Open". Appropriate correction is required.

Claim Objections

3. Claim 9 objected to because of the following informalities: This claim is identical in scope as claim 8 and, therefore, will be rejected as claim 8. Appropriate correction is required.
4. Claims 13 and 14 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. In addition, base claims 11 and 12 must first be rewritten to overcome the rejection(s) under 35 U.S.C. 112, second paragraph, set forth in ¶ 5 of this Office action.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claims 1-14 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 1:

This claim discloses two “pattern data” sets, “pattern data for a pattern dependency test” and pattern data for a timing dependency test”. It is not clear to the Examiner if the data patterns disclosed in the claim limitation is one set of pattern data or two separately distinct sets of pattern data. Timing testing is inherently part of a data pattern set in a synchronous design because the data is clocked from a clock signal. This renders the claim vague and indefinite. If the disclosed pattern data is one set of data patterns then the claim should read, “said pattern data” for the timing dependency test. If the disclosed data pattern is two separately distinct sets of data patterns the claim language should more clearly distinguish between the two. Further clarification of the claim language is required.

Claims 2-14:

These claims are rejected because they depend on claim 1 and contain the same problems of indefiniteness.

Claim 6:

This claim recites the limitation “the decision circuit” in line 3. There is insufficient antecedent basis for this limitation in the claim. It is not clear to the Examiner which “a result of decision on the test result” this claim is based on, i.e. the “input level

decision" of claim 4 or "the signal indicative of the test result of the BIST circuit of claim 5. Further clarification of the claim language is required.

Claim 7:

This claim recites the limitation "the decision circuit" in line 10. There is insufficient antecedent basis for this limitation in the claim.

Claim 11:

This claim recites the limitation "the decision circuit" in lines 10 and 13. There is insufficient antecedent basis for this limitation in the claim.

Claim 12:

This claim recites the limitation "the decision circuit" in line 2. There is insufficient antecedent basis for this limitation in the claim.

Claims 13 and 14:

These claims are rejected because they depend on claim 11 and contain the same problems of insufficient antecedent basis.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Art Unit: 2133

6. Claims 1-3, 5, 6, 8, 9, 11, 12 and 15 are rejected under 35 U.S.C. 102(e) as being anticipated by Kraus et al. (US-6587979), hereinafter Kraus.

Claim 1:

Kraus teaches that the BIST circuit 7 (test circuit) communicates with a BIST controller circuit 8 (test device) which, as illustrated in FIG. 3A, may be implemented by a separate IC mounted on the same circuit board (load board 9) on which IC 2A is mounted when being tested by IC tester 5 (external test unit). (Col. 5, lines 20-24). Kraus also teaches the BIST circuit receives and stores data from the controller in the scan register. (Col. 3, lines 8, 9). Kraus discloses BIST circuit 11 includes a separate "core wrapper" 24 positioned near each RAM 12 which includes a scan register 46 for storing data, address and control signals appearing on bus 32 in response to the CAPTURE signal from tester 21 and shifts out its stored data onto the SHIFT_OUT line of scan bus 23 in response to successive pulses of the SHIFT signal from tester 21. (Col. 7, lines 64, 65, Col. 11, lines 53-58).

Claim 15:

Kraus teaches the BIST circuit receives and stores data from the controller in the scan register. (Col. 3, lines 8, 9). Kraus also teaches BIST circuit 11 includes a separate "core wrapper" 24 positioned near each RAM 12 which includes a scan register 46 for storing data, address and control signals appearing on bus 32 in response to the CAPTURE signal from tester 21 and shifts out its stored data onto the SHIFT_OUT line of scan bus 23 in response to successive pulses of the SHIFT signal from tester 21. (Col. 7, lines 64, 65, Col. 11, lines 53-58).

Claim 2:

Kraus teaches that the BIST circuit 7 (test circuit) communicates with a BIST controller circuit 8 (test device) which, as illustrated in FIG. 3A, may be implemented by a separate IC mounted on the same circuit board (load board 9) on which IC 2A is mounted when being tested by IC tester 5 (external test unit). (Col. 5, lines 20-24).

Kraus teaches that the functions of the BIST controller 68 of FIG. 8 can be implemented by a built off-chip self test (BOST) circuit 67 (FIG. 12), an integrated circuit mounted on load board 66. (Col. 15, lines 40-43). Relating this to FIG. 3A, the BIST controller circuit 8 (test device) is now implemented by a separate IC as the built off-chip self test (BOST) circuit 67.

Claim 3:

Kraus teaches an external host computer 74 (external test device) writes a test program into RAM 70 via conventional computer bus 76, and then sends a START command (control signal) to BOST controller 71 (BOST device) via bus 76 telling it to execute that test program. (Col. 14, lines 64-67, Col. 15, line 1)

Claim 5:

Kraus teaches a built-in self-test (BIST) circuit 11 incorporated into IC 10 for carrying out or facilitating any of several different types of tests on IC 10 (performing a pattern dependency test) including directly testing each RAM 12, and assisting in tests of logic circuits 14, 16. (Col. 6, lines, 47-51). Kraus also teaches when the core wrapper 24 (BIST circuit) detects a defective memory cell, it pulses an output current error signal (CERR). (Col. 11, lines 12-14). Kraus further teaches also teaches the BIST circuit 7

(BIST circuit) communicates with a BIST controller circuit 8 (BOST device). (Col. 5, lines 20-24).

Claim 6:

Kraus teaches In its "bit map" mode of operation, each core wrapper 24 (BOST device, see claim 11 rejection) loads test result data (reference data) for each addressable memory cell into its internal scan register so that tester 21 can acquire that data via scan bus 23 (provided to the external test unit). (Col. 10, lines 34-37).

Claim 8 and 9:

Kraus teaches BIST circuit 7 (semiconductor device) communicates with a BIST controller circuit 8 (BOST device) which, as illustrated in FIG. 3A, may be implemented by a separate IC mounted on the same circuit board (load board 9) (second contactor) on which IC 2A is mounted. Kraus further teaches an external BIST controller 8 (BOST device) may then be coupled to BIST circuit 7(semiconductor device), for example, through contact points 4D (e.g. probe contact pads) (first contactor) on IC 2A (wafer). (Col. 5, lines 20-24, 66,67, col. 6, line 1).

Claim 11:

Kraus teaches the functions of core wrappers 24, glue logic 36 and BIST controller 68 of FIG. 8 can be implemented by a built off-chip self test (BOST) circuit 67 (BOST device) as an integrated circuit mounted on load board 66. Kraus also teaches the core wrapper 24 includes a tester circuit 40 which also includes a pattern generator 50 (all part of the BOST device) clocked by the CLOCK signal for generating data, address and control data patterns supplied as inputs to RAM 12 via multiplexers 42-44

during a RAM test. Kraus further discloses pattern generator 50 (pattern generating circuit) includes a data generator 70 clocked by a DATA CLOCK signal from a sequencer 72 (generates clock) for producing the data pattern to be placed on the data input lines (DI) of RAM 12 (see FIG. 6). (Col. 12, lines 12-14, Col. 15, lines 40-57).

Kraus further teaches an external BIST controller 8 (BOST device) may then be coupled to BIST circuit 7 (semiconductor device), for example, through contact points 4D (e.g. probe contact pads) on IC 2A (second interconnection). (Col. 5, lines 66,67, col. 6, line 1).

Claim 12:

Kraus teaches a skew circuit 81 (decision circuit includes a measuring circuit) adjustably delays (measuring and access time) each of the DI, ADDR and CNT outputs of data generator 60, filters 78 and 80, and sequencer 72 with delays controlled by the SKEW data input from JTAG register 55 of FIG. 6. The delays are set to accommodate the timing requirements of the RAM under test.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kraus et al. (US-6587979), hereinafter Kraus.

Claim 10:

Kraus teaches BIST circuit 7 (semiconductor device) communicates with a BIST controller circuit 8 (BOST device) which, as illustrated in FIG. 3A, may be implemented by a separate IC mounted on the same circuit board (load board 9) (a contactor substrate for connecting the BOST device to the semiconductor device) on which IC 2A is mounted. Kraus further teaches an external BIST controller 8 (BOST device) may then be coupled to BIST circuit 7 (semiconductor device), for example, through contact points 4D (e.g. probe contact pads) on IC 2A (wafer). (Col. 5, lines 20-24, 66,67, col. 6, line 1). Kraus does not explicitly teach "a socket retaining the BOST device. It would have been obvious to one of ordinary skill in the art at the time the invention was made that implementing a BIST controller circuit 8 (BOST device) as a separate IC and mounting it on the same load as the BIST circuit 7 (semiconductor device) would require a socket. The artisan would have been motivated to do so because this would enable Kraus to interchange a BIST controller with a BOST device as the testing needs of the semiconductor device require.

8. Claims 4 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kraus et al. (US-6587979), hereinafter Kraus, in view of Leas et al. (US-5600257), hereinafter Leas.

Claim 4:

Kraus does not explicitly teach “the external tester unit provides the BOST device with an output level generating voltage”. However, Leas teaches test chip 32 (BOST device) includes controllable voltage regulator circuit 140 which is both gated and variable. Leas also teaches regulator circuit 140 is configured to receive a reference signal voltage (output level voltage) at pad 89a directly from test apparatus 58 (external test unit) (shown in FIG. 2) through reference signal line 89b. Leas further teaches the reference signal voltage is used to set the regulated output voltage level desired from voltage regulator circuit 140 (determine an input level). (Col. 9, lines 5-26). It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Kraus's BIST controller 8 (BOST device) to include Leas's voltage regulator circuit 140. The artisan would have been motivated to do so because it would enable Kraus to control the reference voltage signal level to supply proper signal levels to the semiconductor device during testing.

Claim 7:

Kraus teaches an external BIST controller 8 (BOST device) may then be coupled to BIST circuit 7(semiconductor device), for example, through contact points 4D (e.g. probe contact pads) on IC 2A (contactor substrate). (Col. 5, lines 66,67, col. 6, line 1). Kraus does not explicitly teach “a switch circuit for disconnecting the BIST controller 8 (BOST device) from the BIST circuit 7(semiconductor device). However, Leas teaches that test signals are distributed to test chips along the surface of test wafer 30, preferably in the region between test chips 32. leas further illustrates in FIG. 3b, signal I/O lines are received on test chip pads 86a of test chips 32 (BOST device) and

switches 84 (switch circuit) are provided on test chips 32 (BOST device) to disconnect test signals from a product chip (semiconductor device). (Col. 8, lines 46-59). It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Kraus's BIST controller 8 (BOST device) to include Leas's switches 84 (switch circuit). The artisan would have been motivated to do so because this would enable Kraus to disconnect test signals from a semiconductor device having a shorted I/O or other short. In addition, I/O can also be disconnected from semiconductor devices that are otherwise disconnected from power to avoid dragging down a common I/O line.

Allowable Subject Matter

The following is an Examiner's Statement of Reasons for Allowance:

The prior arts of record teach a test apparatus for testing a semiconductor device that comprises of and external test unit, a BIST circuit and a BOST circuit coupled between the external test unit and a BIST circuit. The prior arts of record also teach a skew circuit 81 (decision circuit includes a measuring circuit) for adjusting delays (measuring and access time) of various signals in the semiconductor device; Kraus et al. (US-6587979) is one example of such prior arts. The prior arts of record, however, fail to teach, singly or in combination, that the measuring circuit includes a logic circuit which performs a EOR operation on the clock signal and the output signal from the semiconductor device and a frequency counter (claim 13). The prior arts of record also fail to teach, singly or in combination, that the measuring circuit further includes an OR

circuit, an AND circuit, a first frequency counter, a second frequency counter, and an access-time measuring circuit (claim 14).

Any comments considered necessary by applicant must be submitted no later than the payment of the Issue Fee and, to avoid processing delays, should preferably accompany the Issue Fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Tsujii (US-6489791)

Tsujii teaches a BOST LSI 8 and a DUT 7 mounted to a single socket 12. Signals from a tester 1 are input to the BOST LSI 1. (Claim 10).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to John J. Tabone, Jr. whose telephone number is (703) 305-8915. The examiner can normally be reached on M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Albert DeCady can be reached on (703) 305-9595. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

John J. Tabone, Jr.
Examiner
Art Unit 2133



for

Albert DeCady
Primary Examiner